

Zero Retries issue 0070 2022-10-28

Zero Retries is an independent email newsletter about technological innovation in Amateur Radio, for a self-selecting niche audience. It's free (as in beer) to subscribe.

About Zero Retries

Steve Stroh N8GNJ, Editor

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In this issue:

- Request To Send
 - 450+ Subscribers!
 - Zero Retries Omnibus - Now Every 15th Issue
 - Welcome back Pseudostaffer Jeff Davis KE9V
 - More on Practical / Hands-on Aspects of Learning
- GNSS Jamming - Not Just For Military Operations?
- Big Project for Organization X - *Now* It Can Be Told
- Regarding Fusion
- ZR > BEACON
 - First installment of my donations to DLARC
 - MicroHAMS SatNOGS Presentation
 - QO-100 Bits
 - Inovato Quadra
 - Ribbit
- Feedback Loop
- Join the *Fun* on Amateur Radio
- Closing The Channel

Request To Send

450+ Subscribers!

I am happy to report that Zero Retries' subscriber count is now 450+. Thanks folks! In imagining Zero Retries, my guesstimate of subscribers was perhaps half this number. As I said in RTS in Zero Retries 0069:

With all you Zero Retries readers sharing my fun of endless discovery about Amateur Radio and data communications, satellites, microwave communications, all of that... I'm blessed to have you all along for the ride.

Zero Retries Omnibus - Now Every 15th Issue

In Zero Retries 0039 I began trying to create and maintain an "Omnibus" of "Zero Retries Interesting" information for easy reference. I intended to update the Omnibus every tenth (10th) issue. Having tried that thrice now, I decided that every ten issues was a tad too frequent (and ambitious). I'm revising that goal to every fifteenth (15th) issue, which feels saner and equivocates (roughly) to quarterly updates. Thus, the next Omnibus issue will be Zero Retries 0075, currently scheduled for publication on 2022-12-02.

Welcome back Pseudostaffer Jeff Davis KE9V

Of late, KE9V has been spotting some [great Zero Retries Interesting items](#) on his [blog](#) (a must-read for me), especially items related to Amateur Radio space activities, which is an area that I'm not well "attuned" to at the moment.

More on Practical / Hands-on Aspects of Learning

Zero Retries, as I write it, is always a balancing act between length and the self-imposed deadline to publish at 15:30 Pacific on Fridays.

There's usually more I want to say, if I had the time or the space, but I've learned that... generally... the size and deadline constraints are a good thing. They force me to be more concise (very much a work in progress) and to [ship my work](#). When I re-read Zero Retries after it ships, if I feel that what I wrote isn't complete enough or could be better, I can always do a followup - like this.

Last week in Zero Retries 0069 I told part of the story about my first encounter with a personal computer during my Electronics Technician training. I didn't mention that I attended what was then called "Ohio Institute of Technology" in Columbus, Ohio which is one of the DeVry schools.

One of the interesting things about OIT (when I attended in 1978-1980), was that instructors for the (non-accredited) Electronic Technician program weren't required to have teaching credentials, only *practical* experience in the subject matter and the *ability* to teach. The goal of

the Electronic Technician program at OIT was to impart the practical aspects of electronics to students eager to soak up enough knowledge of electronics to get a good job. I learned electronics from some remarkable instructors, including one instructor who was one of the crew on the gantry during the [Apollo 1 fire](#) that killed three astronauts, and an instructor for Two Way Radio and Television Repair that was a former television repairman. The most influential instructor at OIT, to me, was David L. Heiserman. Heiserman was a [prolific book author](#); his best-known title (at the time) was “Build Your Own Working Robot”. Heiserman taught the Microprocessors class at OIT. It was a new class after it became apparent to OIT that microprocessors weren’t a fad in the electronics industry and their graduates would have to know about microprocessors in addition to digital logic. When I discovered that Heiserman was a successful published author, I asked why he decided to be an instructor at OIT. He told me that writing had become a bit stale to him, and he wanted to try being an instructor. (My memory is that Heiserman only did one trimester at OIT, and decided that writing was an easier way to earn a living).

Heiserman taught his microprocessor class by building on our other classes in digital logic - how to understand and troubleshoot electronic systems with digital integrated circuits, so he explained the internal digital logic of the most popular microprocessor of that time, the Intel 8080. He also required us to have some knowledge of how the 8080 processed software, which is what made microprocessors vastly different than collections of digital integrated circuits, whose functions could only be changed by physically changing the hardware. Heiserman got OIT to purchase an MITS Altair 8800 and nine Cathode Ray Tube (CRT) dumb terminals. My memory of this is now 40 years old, but I think Heiserman told us that he had spent the summer prior to his first OIT class creating a “timesharing” environment on the Altair 8800 to allow eight students to simultaneously be on a terminal programming in 8080 assembly language. Each student could write, execute, debug, and store their machine language programs in their own environment (something like 1 kB). By today’s standards that experience is laughably simplistic, but that little bit of hands-on programming was a profound change from the lecture / homework / solder approach that OIT had used until then. (We had a bit of a laugh; the Engineering students had long had programming classes... on an IBM minicomputer, whose input for programming exercises was punch cards. I think we Technician students got the better experience.)

Here’s the crossover to Zero Retries and Amateur Radio - Heiserman’s approach to instruction about microprocessors enabled me to understand “the whole stack”, from an instruction entered into the terminal, to how that changed the logic flow in the microprocessor, to the electron flow in the transistors of the logic gates.

For radio technology, experience with Amateur Radio is the equivalent of that hands-on machine language programming activity. When you get *involved* in Amateur Radio (not just study and obtain your license), that hands-on aspect enables you to start understanding just how radio technology *works*. Just changing the antenna on a portable radio from a “rubber duck” to a extendable whip which gets you into the repeater much better is a revelation. With that experience you begin to understand the physics of wavelengths and the practicalities of antennas. Experimenting with various data modes helps you understand how mobile phone technology works. You start to understand the relationship between signal gain (either computationally or electrically) and transmit power and antennas. That’s why I’ve come to view experience with Amateur Radio as a technology superpower - with that experience,

everything about radio technology begins to make sense instead of just being a “black box” that mostly works if you follow the guidelines, but you don’t know how or why those guidelines are what they are.

Sadly Heiserman is now a [silent keyboard](#) (honorary title - I didn't find any evidence that he was an Amateur Radio Operator.) I’m profoundly grateful to David L. Heiserman - I was lucky to be in that one class of his at OIT.

de Steve N8GNJ

GNSS Jamming - Not Just For Military Operations?

Apparently I wasn’t so paranoid after all in my article in Zero Retries 0067 - GPS Jamming - Correspondence with Time Nut John Ackermann N8UR in imagining the jamming of Global Navigation Satellite Service (GNSS)[1](#) signals. It *is* happening, per this recent article in ARS Technica by Dan Goodin 2022-10-19 - [GPS interference caused the FAA to reroute Texas air traffic](#).

Experts stumped.

Episode lasting almost 2 days prompted the closure of a runway at Dallas airport.

The Federal Aviation Administration is investigating the cause of mysterious GPS interference that, over the past few days, has closed one runway at the Dallas-Fort Worth International Airport and prompted some aircraft in the region to be rerouted to areas where signals were working properly.

The interference first came to light on Monday afternoon when the FAA issued an advisory over ATIS ([Automatic Terminal Information Service](#)). It warned flight personnel and air traffic controllers of GPS interference over a 40-mile swath of airspace near the Dallas-Fort Worth airport. The advisory read in part: “ATTN ALL AIRCRAFT. GPS REPORTED UNRELIABLE WITHIN 40 NM OF DFW.”

...

Then, around 11 pm Dallas time, the interference ended. As mysteriously as the interference began, it had stopped.

And this, more directly related to precision timing derived from GNSS - from Financial Times (paywalled) by Anjana Ahuja 2022-10-25 - [We are dangerously reliant on GPS to tell the time](#).

Recent outages in satellite systems have confirmed the importance of data from atomic clocks as an invisible utility.

...

Aviation is just one sector that relies on GPS, or, more accurately, GNSS — the Global Navigation Satellite System, an umbrella term for all satellite navigation

constellations, which include GPS and Galileo — to tell time and position. Other sectors, including energy, telecommunications and broadcast, also depend on GNSS for timing, and can be plunged into chaos if signals from space are disrupted. As a result, the National Physical Laboratory, the UK's official timekeeper, is now designing a [time-signaling] system that will bypass satellites, making it more robust against accidental or deliberate interference.

To me, the first puzzling aspect of the DFW GPS jamming issue is that if this issue continued for two days... apparently the jamming was continuous. If so, is the US Federal Communications Commission (FCC) and / or US Federal Aviation Administration (FAA) so understaffed / underfunded / unsophisticated... or, just incompetent... *to not be able to track down the source of the jamming?*

Amateur Radio Operators do [Transmitter Hunting](#) for fun. Perhaps it's time to elevate this skill by teaching (and equipping?) Amateur Radio Operators to rapidly mobilize volunteer teams with skills and equipment to perform such searches of interference, similar to how volunteer Search and Rescue teams are organized? That's now possible using equipment such as the [KrakenSDR](#) which covers the US GPS frequencies:

- GPS L1 Band: 1575.42 MHz with a bandwidth of 15.345 MHz
- GPS L2 Band: 1227.6 MHz with a bandwidth of 11 MHz
- GPS L5 Band: 1176.45 MHz with a bandwidth of 12.5 MHz

The KrakenSDR incorporates 5 such receivers that are phase-coherent, and thus automated direction finding is possible.

The second puzzling aspect of this issue is that it's known that GNSS signals can sometimes be unreliable, and unlike the occasional bad turn by turn directions of land navigation, not knowing that GNSS signals are unreliable can be catastrophic for aircraft, thus the development of the [Wide Area Augmentation System \(WAAS\)](#).

I'm only speculating, but it seems to me that GNSS jamming, should be less of a liability than it apparently is, and there should be countermeasures created such as the ability to find GNSS interference *fast*.

Big Project for Organization X - Now It Can Be Told

*Speaking of things I've **done**...*

In Request to Send in Zero Retries 0031 (2022-02-04) I teased:

I spent most of this week working on “Big Project for Organization X” that requests that I not disclose the organization's name or the project. (It's not ARDC.) I was honored to be asked to participate in “Big Project...” as it is something I respect. I'm proud of my part in “Big Project for Organization X”, and look forward to it being revealed at some point in the future.

I can now reveal that “Big Project for Organization X” was the ARRL Handbook for Radio Communications - 100th Edition. As of Zero Retries 0069 last week, the 100th Edition had been announced thus it was timely for mention in Zero Retries, but at the time I completed Zero Retries 0069, I had not yet received approval from the editor that I was free to discuss my participation. So, now... *the rest of the story.*

I haven't seen the 100th Edition or Chapter 15 - only selected portions for proofreading. I'm told that, as a contributor, I'll receive a copy of the 100th Edition, but as I write this, I haven't yet received it, so I don't know how my contributions ultimately ended up looking in print. In this era, it feels odd to say "... in print" and mean it literally.

My contribution to the 100th Edition was in **Chapter 15 - Digital Protocols and Modes**. To replace the section on the [\(deprecated\) WINMOR data mode](#), I wrote new text about **VARA** (15.5.7) and **Amateur Radio Digital Open Protocol (ARDOP)** (15.5.8). I was gratified that Scott Currie NS7C and Jose Alberto Nieto Ros EA5HVK reviewed my text on VARA.

As I reviewed the previous Chapter 15 (I had not purchased an ARRL Handbook in well over a decade) I provided feedback to the editor that there were a *lot* more sections that would benefit from updates:

- Microwave networking still referred to [HSMM](#) with no mention of HamWAN or AREDN,
- [CLOVER](#) was mentioned as an Amateur Radio digital mode though I've not seen any mention of it in a couple of decades now,
- The APRS section was still discussing [DOS APRS](#),
- The TCP/IP section didn't mention [44Net](#) (aka Net44 aka AMPRNET),
- The Packet Radio section really needed a discussion of [Dire Wolf](#) software and perhaps [Terrestrial Amateur Radio Packet Network \(TARPN\)](#),
- The D-Star section was badly out of date,
- [New Packet Radio](#) seemed worth a mention,
- Many more granular comments.

Had time permitted, I would have loved to help with some of those sections, but it was far more expedient to “divide and conquer” to get the revisions done faster. (I can only imagine the time pressures to get the layouts of this this monster book to a printer and start production!) The editor was able to engage a number of subject matter experts on the above topics and I can't wait to read all of Chapter 15 and learn from them.

Overall this was a fun experience, and I'm proud to have contributed to the 100th Edition. Unlike Zero Retries, “The Handbook” finds its way onto bookshelves in every country, and that's just cool to imagine that my writing is now a part of it.

That project was a couple of weeks of hard work to do just those two sections and the related

reviews and correspondence, so yeah, *books are hard, and time consuming!* But, in the end, it was well worth the effort as it's great to have a (mostly) self-contained description of these technologies for easy reference, especially in comparison to other such technologies used in Amateur Radio. After that experience, and now that I have Zero Retries down to a reasonable process, it might be time to consider a writing a book dedicated to "Digital Protocols and Modes" - with a Zero Retries spin. (Such a book would be an independent project, not an ARRL book.)

Disclaimer - my writing on this project was a work for hire and I'm told that in addition to my complimentary copy of the ARRL Handbook 100th Edition, I'll be paid for my writing and review.

Regarding Fusion

I've had a generally dim view of [Yaesu System Fusion \(YSF\)](#) because given the time when it was developed, Yaesu *could* have chosen to implement excellent (or even good...) data capability, and in my opinion, that could have made YSF the dominant digital voice system in Amateur Radio. Thus, in my opinion, YSF is a lost opportunity between the rabid popularity of Digital Mobile Radio (DMR), the large installed base of D-Star, and the increasing interest in M17 Project's open source development.

This article by Chris Petersen K9EQ was recommended to me by Steve Davidson K3FZT. K9EQ makes some observations about YSF that I had not heard before, thus it seemed appropriate to mention in Zero Retries.

Some thoughts about Fusion, digital modes, and the future.

Fusion uses the lower layers of the P-25 architecture. Modulation, transport, framing, etc. The primary differences revolve around what's in the packet. For example: The use of call signs instead of unit IDs. So Fusion shares most of P-25. FWIW, Fusion is also very similar to DMR. The primary difference is that it doesn't use TDMA – jamming two separate channels into the space of one.

P-25, DMR, NXDN(Kenwood), IDAS (Icom), and Fusion use the same vocoder. D* uses a much older and obsolete vocoder.

Fusion and D* have been optimized, although differently, for Amateur Radio. DMR, NXDN, and IDAS have been optimized for commercial services, like taxi cabs. P-25 has been optimized for government services, like police departments.

Fusion was actually designed by Motorola in that period of time that Motorola owned Yaesu. This benefits Fusion since the vocoder and the signal processing firmware are pretty much the same as what Motorola uses in their radios. (Believe me, not all signal processing firmware is designed the same!) Thus, the performance of Fusion is pretty darn good. Add to that an additional layer for FEC provided by Yaesu's modification to P-25, and the performance of Fusion is better than all the others. (D* is substantially worse than the other protocols.)

...

I recommend the reading the entire article: <https://wp.hamoperator.com/fusion/regarding-fusion/>

ZR > BEACON

[First installment of my donations to DLARC.](#)

I met with Kay Savetz K6KJN, Internet Archive's Program Manager, Special Collections (for Digital Library of Amateur Radio & Communications - DLARC) and gave him the first installment (of probably many) diskettes I had of packet radio software. K6KJN has deep skills in pulling data off floppy disks and preserving them for Internet Archive. (None of my nearly 200 pounds of donated paper have shown up on DLARC yet.)

MicroHAMS SatNOGS Presentation

I'm a (probably lapsed) member of the [MicroHAMS Amateur Radio Club2](#) in Redmond, Washington. During their most recent meeting on 2022-10-18 was a very interesting presentation about SatNOGS (Satellite Networked Open Ground Stations) by Dan White AD0CQ. While the video of that presentation is promised... someday... posted... somewhere... AD0CQ posted his [informative 36 slide deck online](#). I was aware of SatNOGS and had done some reading, and AD0CQ answered a primary question for me, whether mechanically steerable antennas were required for an effective SatNOGS station. (The answer is no.)

QO-100 Bits:

- [QO-100 High Speed Modem and Weather Station](#) - Tom Van den Bon ZR6TG and all the other Amateur Radio Operators using the using the High Speed Multimedia Modem on the QO-100 payload in geostationary orbit over Africa are just having too much fun - *I am envious!*
- [DP0POL/mm3 permanently accessible via QO-100](#) *On October 10, 2022 at 12:00 UTC, the new QO-100 station was officially commissioned aboard the research vessel Polarstern in an opening ceremony. Andreas DL3LRM, operator of DP0POL/mm and Peter DB2OS at station DK0SB of AMSAT-DL and Observatory Bochum, performed the initial connection. After that, the satellite station is permanently available for general radio calls via QO-100, of course only as long as the free time of the radio amateurs on the ship allows it. A special feature of the QO-100 station on board Polarstern is the fully automatically tracked satellite antenna under the radome, which has to withstand even the most adverse weather conditions and enables a secure connection to the geostationary amateur radio satellite even in heavy seas.*

Thanks to Jeff Davis KE9V for the pointers to both these stories.

[Inovato Quadra](#)

While we're all waiting for Raspberry Pi to have sufficient production to allocate a few for us non-profit hobbyists, other vendors are stepping in to take advantage of Raspberry Pi's production versus demand shortfalls. The Quadra is a very small computer in an enclosure. If you need a small, dedicated, inexpensive Linux box, the Quadra might be worth considering. The price is low enough that you can buy a few purely for experimentation. I became aware of the Quadra from the Mount Baker Amateur Radio Club's Digital Group. Budd Churchward WB7FHC made a [video of that discussion](#) available.

Meet Quadra: A \$29.95 complete mini-PC for school, home, hobby

Not just a raw board, Quadra is a complete modern Linux computer that can be used as a server or light-use desktop. It includes the case, heatsink, power adapter and HDMI cable. Just plug into a TV or monitor and a keyboard/mouse. No SD card needed as the OS (Debian Bullseye 64-bit) is pre-flashed in internal memory. A great option instead of Raspberry Pi when you don't need the 40-pin I/O header or want something more affordable that doesn't require assembly.

[Ribbit](#)

A new digital text messaging mode for use with two way radios. I only skimmed the [video presentation](#), but very basically Ribbit is an Android app that turns on the phone's microphone to listen for its data format from a radio transceiver's speaker. When it hears appropriate audio, it decodes and displays the text. There's no cabling (required) between the phone and radio, though a cable may improve the reliability.

Leave a comment

Share

Feedback Loop

There were three informative comments on Zero Retries 0069 - *very much appreciated!*

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out

Join the Fun on Amateur Radio for some pointers.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything*!
- Pseudostaffers [Dan Romanchik KB6NU](#) and [Jeff Davis KE9V](#) for continuing to spot, and write about “Zero Retries Interesting” items on his blog that I don’t spot on my own.
- [Amateur Radio Weekly](#) and [Southgate Amateur Radio News](#) consistently surface “Zero Retries Interesting” stories.
- The [Substack email publishing platform](#) makes Zero Retries possible. I recommend it for publishing newsletters.

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Leave a comment

Email issues of Zero Retries are “instrumented” by [Substack](#) to gather basic statistics about opens, clicking links, etc. I don’t use such information in any way other than seeing that most subscribers actually do read Zero Retries.

More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*

- [N8GNJ blog](#) - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted in beautiful Bellingham, Washington, USA

2022-10-28

If you'd like to reuse an article in this issue, for example for club or other newsletters, just ask. Please provide credit for the content to me and any other authors.

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Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I owe them from way back).

[1](#)

While the US Department of Defense's Global Positioning System (GPS) was the first, and the most widely used, it's now not the only such system. Thus it's more appropriate to use the more generic term Global Navigation Satellite System when not referring specifically to GPS.

[2](#)

Yes, I know that there isn't a proper club website at that URL, and the club officers know it also. I'm told "It's... *complicated*..."

[3](#)

The designation /mm represents "Maritime Mobile" - an Amateur Radio station on a boat or ship.